**ECE 438 Image Analysis & Computer Vision Sample Test #2 NAME\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Answer all questions in space provided. Use back of the pages for extra work. Note that each question is not weighted equally. Show all your work. You should have 6 pages. You have 75 minutes.

#1) Mark the following statements True (T) or False (F)

\_\_\_\_\_ Image analysis can be performed in both the spatial and spectral domains

\_\_\_\_\_ Multiresolution is the best image segmentation method

\_\_\_\_\_ In image analysis, application-specific feedback is of minor importance

\_\_\_\_\_ With the Fourier transform, the phase contains information about the image contrast

\_\_\_\_\_ Nearest neighbor classification is less computationally intensive then nearest centroid

\_\_\_\_\_ Minimizing the number of mis‑classifications is the only consideration when designing a classifier

\_\_\_\_\_ When developing a classification algorithm it is a good idea to test it with the same samples used for developing it.

\_\_\_\_\_ During image segmentation we look for objects that are homogeneous

\_\_\_\_\_ When using a neural network it is best to preprocess the feature data with a PCT

\_\_\_\_\_ Euclidean and city block distance metrics are special cases of the Minkowski metric

\_\_\_\_\_ Edges in images consist of primarily low frequency information

\_\_\_\_\_ Split and merge segmentation requires use if a homogeneity test

#2) a) Find the 5x5 Laws texture energy mask for spots and edges, b) Find the 5x5 Laws texture energy mask for gray level and ripples c) Find the 5x5 Laws texture energy mask for ripples and waves d) What, if any, preprocessing is necessary to use the Laws energy masks?

#3) Given the following two features vectors, find the following distance and similarity metrics:

a) Euclidean distance, b) city block distance, c) maximum value, d) Minkowski distance, with *r* = 2, e) vector inner product f) Tanimoto metric

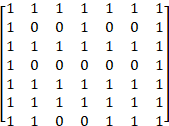
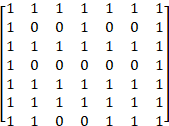
#4) Sketch a bimodal histogram, label the axes. Draw a line to threshold the corresponding image. Briefly describe a method to automatically find the threshold.

#5) a) Define a feature space of at least 4 dimensions, and b) a classification rule to classify image processing systems for computer vision applications versus human vision applications.

#6) We need to devise a computer vision algorithm to identify different types of tools. Specifically hammers, wrenches and screw drivers. a) Describe the procedure you would use with CVIPtools to devise such an algorithm. b) Which features do you think will work the best, and why?

#7) Given the following image and structuring element, perform an opening operation. Assume the origin of the structuring element is in the center. Ignore cases where the structuring element extends beyond the image. OPENING -> Erosion then Dilation

STRUCTURING ELEMENT IMAGE



#8) Given the following feature vectors, with two classes:

Class 1:  Class 2: 

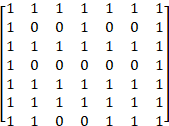
a) Using the Nearest Neighbor classification method, and the absolute value distance metric, classify the following unknown sample vector as Class 1 or Class 2:



b) Use K Nearest Neighbor, with K = 3

#9) Given the following, what will be the resultant pixel values after operating on the following image? Assume all rotations of the surrounds are included in S.

IMAGE



1. S = {2,3,4,5,6}, L(a,b) = , n = 1. Find the resultant pixel values at (r,c) = (3,2) ; (r,c) = (3,3);



(r,c) = (4,5)-and (r,c) = (3,5).

b) S = {7}, L(a,b) = a+b, n = 1. Find the resultant pixel values at (r,c) = (4,5); (r,c) = (2,2); (r,c) = (4,2); and (r,c) = (4,4)

#10) Find the Fourier transform of the following row of an image (4 columns wide):

[ 4 8 8 4 ]. Write the equation and **show all the work for each Fourier value**

#11) Find the gray level co-occurrence matrix for the left diagonal direction (135 and 315 degrees), with d = 1, for the following 2-bit-per-pixel image:

